CLAIMS

What is claimed is:

1. A method for producing a high capacitance core element for integral inclusion in a printed circuit board comprising the steps of:

preparing a slurry by dispersing a hydrothermally prepared nanopowder in a solvent;
preparing a composite mixture by mixing a bonding material with the slurry;
forming the composite mixture into a dielectric layer less than about 6 mil thickness; and
disposing a conductive layer upon at least one side of the dielectric layer.

2. The method of claim 1 further comprising the step of curing the dielectric layer.

3. The method of claim 1 wherein the step of preparing a slurry comprises the step of dispersing the hydrothermally prepared nanopowder in an organic solvent.

4. The method of claim 3 wherein the step of dispersing the hydrothermally prepared nanopowder comprises dispersing the powder in an initial volumetric ratio of between about 20 percent and about 40 percent powder by volume.

5. The method of claim 3 wherein the step of dispersing comprises dispersing the nanopowder in a member selected from the group consisting of methyl ethyl ketone, dimethyl formamide, and a mixture of methyl ethyl ketone and dimethyl formamide.

6. The method of claim 1 wherein the step of preparing a slurry comprises sonicating the nanopowder and the solvent.

7. The method of claim 1 wherein the step of preparing a slurry comprises milling the nanopowder and the solvent.

8. The method of claim 3 wherein the step of preparing a slurry comprises generating a colloidal suspension by mixing a surfactant with the nanopowder and solvent.

9. The method of claim 7 wherein the step of preparing a composite mixture comprises adding a polymer matrix material to the colloidal suspension to form a homogenous powder-polymer-solvent suspension.

10. The method of claim 1 wherein the steps of preparing a composite mixture and curing the dielectric layer result in a dielectric layer having between about 40 percent and about 55 percent nanopowder by volume.

11. The method of claim 1 wherein the step of forming the composite mixture into a dielectric layer comprises impregnating a fiberglass sheet with the composite mixture.

12. The method of claim 1 wherein the step of forming the composite mixture into a dielectric layer comprises selecting a member from the group consisting of extruding, spraying, rolling, dipping, and casting the composite mixture.

13. The method of claim 1 wherein the step of disposing a conductive layer comprises laminating a conductive foil onto the dielectric layer.

14. The method of claim 1 wherein the step of disposing a conductive layer comprises placing the composite mixture upon a conductive foil prior to curing the dielectric layer.

15. The method of claim 1 wherein the step of disposing a conductive layer comprises metallizing the side of the dielectric layer.

16. The method of claim 15 wherein the step of metallizing comprises evaporating, sputtering, or chemical vapor depositing a conductive material upon the dielectric layer.

17. A method for producing a high capacitance core element for integral inclusion in a printed circuit board comprising the steps of:

preparing a composite mixture by mixing a bonding matrix material with a slurry comprising a suspension of hydrothermally prepared nanopowder;

forming the composite mixture into a dielectric layer; and

disposing the dielectric layer between two conductive layers.

18. The method of claim 17 further comprising the step of dispersing the hydrothermally prepared nanopowder in an organic solvent.

19. The method of claim 18 wherein the step of dispersing the hydrothermally prepared nanopowder comprises dispersing the powder in an initial volumetric ratio of between about 20 percent and about 40 percent powder by volume.

20. The method of claim 18 further comprising the step of sonicating the nanopowder and the solvent.

21. The method of claim 18 further comprising the step of milling the nanopowder and the solvent.

22. The method of claim 17 further comprising the step of mixing a surfactant with the nanopowder and solvent.

23. The method of claim 17 wherein the step of mixing a bonding matrix material comprises mixing a polymer to form a nanopowder-polymer-solvent suspension.

24. The method of claim 17 further comprising the step of curing the composite mixture to produce a dielectric layer having between about 40 percent and about 55 percent nanopowder by volume.

25. The method of claim 17 wherein the step of forming the composite mixture into a dielectric layer comprises impregnating a fiberglass sheet with the composite mixture.

26. The method of claim 17 wherein the step of forming the composite mixture into a dielectric layer comprises selecting a member from the group consisting of extruding, spraying, rolling, dipping, and casting the composite mixture.

27. The method of claim 17 wherein the step of disposing a conductive layer comprises laminating a conductive foil onto the cured dielectric layer.

28. The method of claim 17 wherein the step of disposing a conductive layer comprises the steps of:

placing the composite mixture upon a conductive foil; and then
curing the dielectric layer.

29. The method of claim 17 wherein the step of disposing a conductive layer comprises metallizing the side of the dielectric layer.

30. The method of claim 29 wherein the step of metallizing comprises evaporating, sputtering, or chemical vapor depositing a conductive material upon the dielectric layer.

31. A dielectric material integrally included in a printed circuit board said dielectric material comprising a ferroelectric nanopowder having a cubic crystalline structure prepared using a low temperature chemical precipitation process and having particle size ranging from about 10 to 200 nanometers, a polymer resin, preferably a polymer epoxy, intermittently dispersed in the form of a film, said film disposed between two conducting layers.

32. The dielectric material of claim 31 wherein said film comprises a nanopowder/bonding agent ratio of about 30 to about 60 percent powder by volume.

33. The dielectric material of claim 31 wherein said dielectric nanopowder is barium titanate.

34. The dielectric material of claim 31 wherein said conducting layers comprise copper.

35. The dielectric material of claim 31 further comprising a surfactant, preferably a non-ionic phosphate ester.